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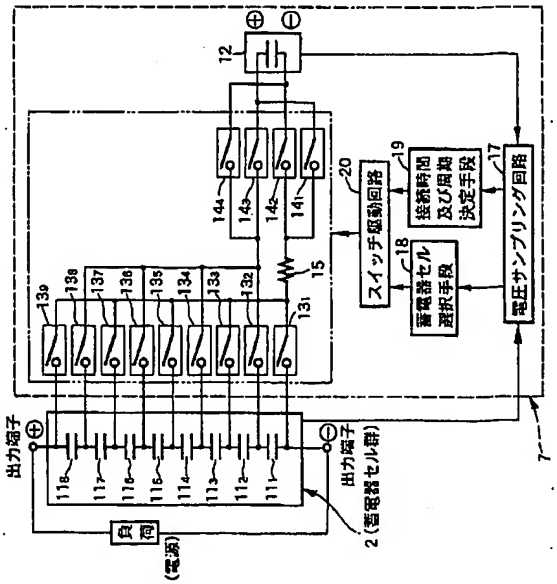
(54)【発明の名称】　蓄電器の電圧制御装置

(57)【要約】

【課題】　個々の蓄電器セルの性能のばらつきによる電圧差を解消して蓄電器セル群全体としての使用電圧範囲を拡大する。

【解決手段】　蓄電器セル群2を構成する8個の蓄電器セル11_1～11_8は、9個のセル切換スイッチ13_1～13_9と、4個の極性反転スイッチ14_1～14_4と、1個の電流制限用抵抗15とを介して電圧補正用蓄電器12に選択的に接続可能である。各蓄電器セル11_1～11_8の電圧にばらつきがあっても、電圧の高い蓄電器セルから電圧補正用蓄電器12に電荷を移動させ、その電圧補正用蓄電器12の電荷を電圧の低い蓄電器セルに移動させることにより、各蓄電器セル11_1～11_8の電圧を均一化することができる。



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【特許請求の範囲】
【請求項１】　複数の蓄電器セル（１１$_1$～１１$_8$）を直列に接続してなる蓄電器セル群（２）の前記各蓄電器セル（１１$_1$～１１$_8$）の電圧を均一化するための蓄電器の電圧制御装置において、
各蓄電器セル（１１$_1$～１１$_8$）に対して並列に接続された電圧補正用蓄電器（１２）と、
任意の蓄電器セル（１１$_1$～１１$_8$）を選択する蓄電器セル選択手段（１８）と、
選択された蓄電器セル（１１$_1$～１１$_8$）及び電圧補正用蓄電器（１２）間に電荷移動を行うための回路（１６）を構成する開閉手段（１３$_1$～１３$_9$，１４$_1$～１４$_4$）と、
開閉手段（１３$_1$～１３$_9$，１４$_1$～１４$_4$）を開閉制御する制御手段（１９）と、を備えたことを特徴とする蓄電器の電圧制御装置。
【請求項２】　前記蓄電器セル群（２）は電気二重層型蓄電器から成ることを特徴とする、請求項１記載の蓄電器の電圧制御装置。
【請求項３】　電圧補正用蓄電器（１２）の静電容量値は蓄電器セル（１１$_1$～１１$_8$）の静電容量値に対して充分に小さい値であることを特徴とする、請求項１記載の蓄電器の電圧制御装置。
【請求項４】　蓄電器セル選択手段（１８）は蓄電器セル（１１$_1$～１１$_8$）を電圧が高い順に選択することを特徴とする、請求項１記載の蓄電器の電圧制御装置。
【請求項５】　制御手段（１９）は開閉手段（１３$_1$～１３$_9$，１４$_1$～１４$_4$）を開閉して蓄電器セル（１１$_1$～１１$_8$）及び電圧補正用蓄電器（１２）を接続する接続時間及び周期を制御することを特徴とする、請求項１記載の蓄電器の電圧制御装置。
【請求項６】　前記蓄電器セル群（２）を複数個直列に接続し、各蓄電器セル群（２）に接続された第１の電圧補正用蓄電器（１２）を第２の電圧補正用蓄電器（２１）に選択的に接続することを特徴とする、請求項１記載の蓄電器の電圧制御装置。
【請求項７】　前記蓄電器セル群（２）を複数個直列に接続し、各蓄電器セル群（２）に接続された電圧補正用蓄電器（１２）を、自己の蓄電器セル群（２）の蓄電器セル（１１$_1$～１１$_8$）と他の蓄電器セル群（２）の何れかの蓄電器セル（１１$_1$～１１$_8$）とに選択的に接続することを特徴とする、請求項１記載の蓄電器の電圧制御装置。
【請求項８】　走行用駆動源としてエンジン（Ｅ）及びモータ（Ｍ）を備えたハイブリッド車両（Ｖ）において、前記蓄電器セル群（２）は発電機（Ｍ）が発電した電力を蓄電してモータ（Ｍ）を駆動することを特徴とする、請求項１記載の蓄電器の電圧制御装置。
【発明の詳細な説明】
【０００１】

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【発明の属する技術分野】本発明は、複数の蓄電器セルを直列に接続した蓄電器において、各蓄電器セルの電圧を均一化するための蓄電器の電圧制御装置に関する。
【０００２】
【従来の技術】走行用駆動源としてエンジン及びモータを備えたハイブリッド車両において、モータを駆動する電源として複数の蓄電器セルを直列に接続した蓄電器を備えるものが、特開平７－１６３０１４号公報により知られている。
【０００３】かかる蓄電器では、性能上のばらつき（容量、自己放電電流、内部抵抗等）により各蓄電器セルの電圧が不均一になり、充電時に電圧の高い蓄電器セルが早く耐圧に達して蓄電器全体としての使用電圧範囲が狭まったり、耐久性が低下したりする場合がある。そこで上記従来のものは、早く耐圧に達する蓄電器セルにツェナーダイオードを接続して電圧上昇を抑えたり、或いは耐圧に達しようとする蓄電器セルに抵抗やコンデンサに接続して電圧上昇を抑えたりして対処している。
【０００４】
【発明が解決しようとする課題】しかしながら、特開平７－１６３０１４号公報に記載されたものは、蓄電器の満充電時に各蓄電器セルの電圧を均一化するものであり、中間電圧で継続して使用する場合には効果を発揮することができず、また個々の蓄電器セルの固有の性能差を補償するものではないため、長期間の使用に際して他の蓄電器セル間に電圧差が発生して使用電圧範囲が狭まってしまう場合がある。
【０００５】本発明は前述の事情に鑑みてなされたもので、個々の蓄電器セルの性能のばらつきによる電圧差を解消して、蓄電器全体としての使用電圧範囲を拡大するとともに耐久性を向上させることを目的とする。
【０００６】
【課題を解決するための手段】請求項１に記載された発明では、制御手段が開閉手段を開閉して、蓄電器セル選択手段が選択した所定の蓄電器セルと電圧補正用蓄電器とを接続する。蓄電器セルの電荷を電圧補正用蓄電器に移動させた後に、電圧補正用蓄電器の電荷を他の蓄電器セルに移動させ、これを繰り返すことにより各蓄電器セルの電圧が均一化される。
【０００７】請求項２に記載された発明では、蓄電器セル群を構成する電気二重層型蓄電器は小型で大容量を得ることができるため、この電気二重層型蓄電器を用いてエネルギー密度の高い電源システムを構成することができる。
【０００８】請求項３に記載された発明では、電圧補正用蓄電器の静電容量値は蓄電器セルの静電容量値に対して充分に小さい値であるので、蓄電器セルからの電荷によって電圧補正用蓄電器を短時間で充電することができ、これにより速やかに各蓄電器セルの電圧を均一化することが可能となる。

【０００９】請求項４に記載された発明では、電圧が最も高い蓄電器セルから順に電圧補正用蓄電器に接続されるので、電圧が高い蓄電器セルから電圧が低い蓄電器セルに電荷を移動させて蓄電器セル群内の複数の蓄電器セルの最大電圧差を効果的に減少させ、各蓄電器セルの電圧を速やかに均一化することが可能となる。

【００１０】請求項５に記載された発明では、制御手段が開閉手段を開閉することにより蓄電器セル及び電圧補正用蓄電器を接続する接続時間及び周期を制御するので、各蓄電器セルの電圧を任意に制御することができる。

【００１１】請求項６に記載された発明では、それぞれ第１の電圧補正用蓄電器を備えた複数の蓄電器セル群が直列に接続されるので、全ての蓄電器セルの電圧を１個の第１の電圧補正用蓄電器で均一化する場合に比べて、１個の第１の電圧補正用蓄電器が分担する蓄電器セルの数が減って電圧の均一化に要する時間が短縮される。しかも、各第１の電圧補正用蓄電器の電圧が第２の電圧補正用蓄電器により均一化されるので、全ての蓄電器セルの電圧の均一化に要する時間が更に短縮される。

【００１２】請求項７に記載された発明では、それぞれ電圧補正用蓄電器を備えた複数の蓄電器セル群が直列に接続されるので、全ての蓄電器セルの電圧を１個の電圧補正用蓄電器で均一化する場合に比べて、１個の電圧補正用蓄電器が分担する蓄電器セルの数が減って電圧の均一化に要する時間が短縮される。しかも、各電圧補正用蓄電器の電圧が他の蓄電器セル群の何れかの蓄電器セルとの間の電荷移動により均一化されるので、全ての蓄電器セルの電圧の均一化に要する時間が更に短縮される。

【００１３】請求項８に記載された発明では、発電機が発電した電力を蓄電器セル群に蓄えてモータの駆動に有効に利用することができ、しかも蓄電器セル群はバッテリに比べて出力密度が高いので車両の軽量化が可能となる。

【００１４】

【発明の実施の形態】以下、本発明の実施の形態を、添付図面に示した本発明の実施例に基づいて説明する。

【００１５】図１～図６は本発明の第１実施例を示すもので、図１は本発明をハイブリッド車両に適用した制御系のブロック図、図２は電圧制御回路の回路図、図３は電荷移動の作用説明図、図４は作用を説明するフローチャート、図５は最大接続時間の説明図、図６は効果を説明するグラフである。

【００１６】図１に示すように、パラレル型のハイブリッド車両Ｖはエンジン Ｅと、駆動及び回生が可能なモータＭと、トランスミッション Ｔとを備えており、モータＭはモータ駆動回路１を介して蓄電器セル群２に接続される。前記蓄電器セル群２は、小型で大容量を得ることができる電気二重層型蓄電器のセル群から構成される。車両Ｖの走行時には、エンジン Ｅ及び／又はモータＭの駆動力がトランスミッション Ｔを介して駆動輪Ｗに伝達され、またエンジン Ｅの駆動力に余剰が生じた場合や制動時にはモータＭが回生制動され、モータＭの発電した電力が蓄電器セル群２に蓄電される。

【００１７】マネージメント制御装置３にはモータ制御装置４、エンジン制御装置５及びミッション制御装置６が接続されており、モータ制御装置４によって前記モータ駆動回路１が、エンジン制御装置５によってエンジン Ｅが、またミッション制御装置６によってトランスミッション Ｍがそれぞれ制御される。蓄電器セル群２は、後から詳述する蓄電器セル電圧制御装置７により制御される。

【００１８】モータ駆動回路１及び蓄電器セル群２は１２Ｖダウンバータ８を介して１２ボルトの補機用バッテリ９に接続されており、これら蓄電器セル群２及び補機用バッテリ９は充電制御装置１０により制御される。

【００１９】このように、蓄電器セル群２はモータＭが発電した電力を蓄電して該モータＭを駆動するので、エンジン Ｅの余剰の駆動力や制動により捨てられる駆動力を蓄電器セル群２に蓄えてモータＭの駆動に有効に利用することができる。またバッテリに比べて出力密度が高い蓄電器セル群２を用いているので、車両Ｖの軽量化が可能となる。

【００２０】図２に示すように、蓄電器セル群２は同一規格の８個の蓄電器セル 11_1 ～ 11_8 を直列に接続したものであり、各蓄電器セル 11_1 ～ 11_8 の静電容量値は例えば１６００ファラドに設定される。蓄電器セル電圧制御装置７は、１個の電圧補正用蓄電器１２と、９個のセル切換スイッチ 13_1 ～ 13_9 と、４個の極性反転スイッチ 14_1 ～ 14_4 と、１個の電流制限用抵抗１５とを備える。９個のセル切換スイッチ 13_1 ～ 13_9 のうちの所定の２個と、４個の極性反転スイッチ 14_1 ～ 14_4 のうちの所定の２個とを閉成すると、所定の蓄電器セル 11_1～ 11_8 と電圧補正用蓄電器１２とが閉じた回路１６（図３参照）を介して接続される。電圧補正用蓄電器１２の静電容量値は、各蓄電器セル 11_1 ～ 11_8 の静電容量値である１６００ファラドの１０％以下の値（例えば１００ファラド）に設定される。

【００２１】図３（Ａ）に示すように、例えば２個のセル切換スイッチ 13_1 ，13_2 と、２個の極性反転スイッチ 14_2 ，14_3 とを閉成すると、蓄電器セル 11_1 のプラス極と電圧補正用蓄電器１２のプラス極とが接続されるとともに、蓄電器セル 11_1 のマイナス極と電圧補正用蓄電器１２のマイナス極とが電流制限用抵抗１５を介して接続される。また図３（Ｂ）に示すように、２個のセル切換スイッチ 13_2 ，13_3 と、２個の極性反転スイッチ 14_1 ，14_4 とを閉成すると、蓄電器セル 11_2 のプラス極と電圧補正用蓄電器１２のプラス極とが電流制限用抵抗１５を介して接続されるとともに、蓄電器セル 11_2 のマイナス極と電圧補正用蓄電器１２の

マイナス極とが接続される。

【００２２】蓄電器セル電圧制御装置７は、更に電圧サンプリング回路１７と、蓄電器セル選択手段１８と、接続時間及び周期決定手段１９と、スイッチ駆動回路２０とを備える。電圧サンプリング回路１７は、８個の蓄電器セル11_1～11_8の電圧と、電圧補正用蓄電器１２の電圧とを検出する。蓄電器セル選択手段１８は、前記検出した電圧に基づいて８個の蓄電器セル11_1～11_8を電圧が高い順に選択する。接続時間及び周期決定手段１９は前記選択された蓄電器セル11_1～11_8を電圧補正用蓄電器１２に接続する接続時間及び周期を決定する。スイッチ駆動回路２０は前記選択された蓄電器セル11_1～11_8と前記決定された接続時間及び周期に基づいて、セル切換スイッチ13_1～13_9及び極性反転スイッチ14_1～14_4の開閉を制御する。

【００２３】次に、前述の構成を備えた本発明の実施例の作用について説明する。

【００２４】図４は、蓄電器セル群２が最小個数である２個の蓄電器セル11_1，11_2だけを備える場合の作用を説明するフローチャートである。先ず、電圧サンプリング回路１７により２個の蓄電器セル11_1，11_2の電圧をサンプリングし（ステップＳ１）、その結果に基づいて蓄電器セル選択手段１８が最大電圧の蓄電器セル（例えば、蓄電器セル11_1）を選択する（ステップＳ２）。蓄電器セル11_1が選択されると、図３（Ａ）に示すように、スイッチ駆動回路２０が２個のセル切換スイッチ13_1，13_2と２個の極性反転スイッチ14_2，14_3とを閉成する（ステップＳ３）。その結果、蓄電器セル11_1から電流制限用抵抗１５を介して電圧補正用蓄電器１２に電荷が移動し、放電された蓄電器セル11_1の電圧が低下するとともに、充電された電圧補正用蓄電器１２の電圧が上昇する。そして接続時間及び周期決定手段１９により決定された接続時間t_1が経過すると（ステップＳ４）、スイッチ駆動回路２０が２個のセル切換スイッチ13_1，13_2と２個の極性反転スイッチ14_2，14_3とを開成して蓄電器セル11_1を電圧補正用蓄電器１２から切り離す（ステップＳ５）。

【００２５】蓄電器セル11_1から電圧補正用蓄電器１２に電荷を移動するとき、電圧補正用蓄電器１２の静電容量値（１００ファラド）は蓄電器セル11_1の静電容量値（１６００ファラド）に比べて大幅に小さいため、電圧補正用蓄電器１２の電圧は速やかに上昇する。これにより、各蓄電器セル11_1，11_2の電圧の均一化を短時間で行うことができる。

【００２６】続いて、蓄電器セル選択手段１８が次に電圧の高い蓄電器セル（つまり、蓄電器セル11_2）を選択すると（ステップＳ６）。図３（Ｂ）に示すように、スイッチ駆動回路２０が２個のセル切換スイッチ13_2，13_3と２個の極性反転スイッチ14_1，14_4とを閉成する（ステップＳ７）。その結果、電圧補正用蓄電器１２から電流制限用抵抗１５を介して蓄電器セル11_2に電荷が移動し、放電された電圧補正用蓄電器１２の電圧が低下するとともに、充電された蓄電器セル11_2の電圧が上昇する。そして接続時間及び周期決定手段１９により決定された接続時間t_2が経過すると（ステップＳ８）、スイッチ駆動回路２０が２個のセル切換スイッチ13_2，13_3と２個の極性反転スイッチ14_1，14_4とを開成して蓄電器セル11_2を電圧補正用蓄電器１２から切り離す（ステップＳ８）。

【００２７】このようにして、電圧の高い蓄電器セル11_1から電圧の低い蓄電器セル11_2に電荷を移動させることにより、蓄電器セル11_1の電圧が低下して蓄電器セル11_2の電圧が上昇し、両蓄電器セル11_1，11_2の電圧を均一化することができる。

【００２８】ところで、図５（Ａ）に示すように、静電容量Ｃｎ、端子電圧Ｖｃｎの第１蓄電器から静電容量Ｃｆ（但しＣｎ＞＞Ｃｆ）、端子電圧Ｖｃｆ（但しＶｃｎ＞Ｖｃｆ）の第２蓄電器に抵抗値Ｒの電流制限用抵抗を介して電荷を移動させるとき、電荷の移動を開始してからｔ秒後に第２蓄電器の端子電圧がＶｃｆから所望のチャージ電圧であるＶｃｆｔに変化したとする。このとき、電荷移動開始前の第１蓄電器及び第２蓄電器の電圧差をΔV_0（＝Ｖｃｎ－Ｖｃｆ）とし、電荷移動開始後ｔ秒における電圧差をΔV_t（＝Ｖｃｆｔ－Ｖｃｆ）とすると、

$$t = Cf \times R \times Ln\left(1 - \Delta V_t / \Delta V_0\right)$$

が成立する。上式において、ｔは電荷移動開始後に第２蓄電器の電圧がＶｃｆから所望のチャージ電圧Ｖｃｆｔに上昇するまでの時間を表しており、この時間を最大接続時間として定義する。

【００２９】ところで、蓄電器が充電中でも放電中でもないとき、１個の蓄電器セル当たりの最大接続時間ｔが１０秒であると仮定すると、蓄電器が例えばＮ＝１００個の蓄電器セルを有する場合には、１００個の蓄電器セルが各１回の電荷移動を完了するには１０×１００＝１０００秒の時間が必要になり、短時間で各蓄電器セルの電圧を均一化することが難しくなる。そこで、１個の蓄電器セルについての接続時間をｔ／Ｎに設定し、最大接続時間ｔ内にＮ個の蓄電器セルを順次接続して１サイクルとすれば、短時間でＮ個の蓄電器セルから略均等に電荷を移動することができる。

【００３０】また、蓄電器の充電中或いは放電中には、蓄電器セルの端子電圧Ｖｃｎが変化してしまわないように充分に短い時間間隔で各蓄電器セルを接続する必要がある。例えば、接続時におけるＶｃｎの変化速度が０．１ボルト／秒である場合、１個の蓄電器セルについての接続時間を１／Ｎ＝１／１００秒に設定すれば、その間のＶｃｎの変化量を０．００１ボルトに抑えることができる。

【００３１】このように、接続時間及び周期決定手段１

９により各蓄電器セル１１$_1$～１１$_8$を電圧補正用蓄電器１２に接続する周期を変更すれば、各蓄電器セル１１$_1$～１１$_8$の電圧を任意に制御することも可能となる。

【００３２】図６は、図３に示す２個の蓄電器セル１１$_1$，１１$_2$を備えた蓄電器セル群２において、蓄電器セル１１$_1$の初期電圧Ｖｃ$_1$＝２．６ボルト、蓄電器セル１１$_2$の初期電圧Ｖｃ$_2$＝２．３ボルトの状態から、１サイクル２５秒で電荷の移動を行った場合の実験結果を示すものである。同図から明らかなように、最初０．３ボルトあった電圧差が約１０分後に０．１ボルトまで減少し、両蓄電器セル１１$_1$，１１$_2$の電圧が均一化されたことが分かる。

【００３３】以上のように、蓄電器セル群２の８個の蓄電器セル１１$_1$，１１$_8$間で電荷の移動を行うことにより各蓄電器セル１１$_1$～１１$_8$の電圧を均一化しているので、充電時に所定の蓄電器セル１１$_1$～１１$_8$だけが早く耐圧に達するのを防止することができ、これにより蓄電器セル群２全体としての使用電圧範囲を拡大するとともに寿命を延長することができる。

【００３４】次に、図７に基づいて本発明の第２実施例を説明する。

【００３５】第２実施例は複数の蓄電器セル群２…を直列に接続したものである。第１実施例と同様にそれぞれの蓄電器セル群２は電圧補正用蓄電器１２（第１の電圧補正用蓄電器１２）を備えており、それら複数の電圧補正用蓄電器１２…は共通の第２の電圧補正用蓄電器２１に交互に接続される。このように、それぞれ電圧補正用蓄電器１２を備えた複数の蓄電器セル群２…を直列に接続すれば、高電圧を得るために多数の蓄電器セルを用いても、１個の電圧補正用蓄電器１２が分担する蓄電器セルの数を所定個数（８個）に抑えて全ての蓄電器セルの電圧の均一化に要する時間を短縮することができる。しかも各電圧補正用蓄電器１２…が第２の電圧補正用蓄電器２１に選択的に接続されるので、第２の電圧補正用蓄電器２１によって各電圧補正用蓄電器１２…の電圧を均一化し、全ての蓄電器セルの電圧の均一化に要する時間を一層短縮することができる。

【００３６】次に、図８に基づいて本発明の第３実施例を説明する。

【００３７】第３実施例も、第２実施例と同様に複数の蓄電器セル群２…を直列に接続したものである。それぞれの蓄電器セル群２の電圧補正用蓄電器１２は、自己の蓄電器セル群２の８個の蓄電器セル１１$_1$～１１$_8$と、隣接する蓄電器セル群２の１個の蓄電器セル（例えば、蓄電器セル１１$_1$）とに選択的に接続される。従って、１個の電圧補正用蓄電器１２が分担する蓄電器セルの数を９個に抑えて電圧の均一化に要する時間を短縮することができるのは勿論のこと、各電圧補正用蓄電器１２の電圧を隣接する蓄電器セル群２の蓄電器セル１１$_1$との間の電荷の授受により均一化し、全ての蓄電器セルの電圧の均一化に要する時間を一層短縮することができる。

【００３８】以上、本発明の実施例を詳述したが、本発明はその要旨を逸脱しない範囲で種々の設計変更を行うことが可能である。

【００３９】例えば、実施例では蓄電器セル群２が８個の蓄電器セル１１$_1$～１１$_8$を備えているが、その数は８個に限定されるものではない。また請求項１～４に記載された発明はハイブリッド車両用に限定されず、任意の用途の蓄電器に適用することができる。また請求項８に記載された発明は、発電機とモータとを別個に備えたハイブリッド車両に適用することも可能である。更に、蓄電器セル群２とバッテリとを併用することが可能であり、このようにすれば回生時の急激なエネルギー吸収及び蓄電を良好に行うことができ、またバッテリの満充電時には蓄電器セル群２にエネルギーを分岐して蓄電を行うことができる。

【００４０】

【発明の効果】以上のように、請求項１に記載された発明によれば、各蓄電器セルに対して並列に接続された電圧補正用蓄電器と、任意の蓄電器セルを選択する蓄電器セル選択手段と、選択された蓄電器セル及び電圧補正用蓄電器間に電荷移動を行うための回路を構成する開閉手段と、開閉手段を開閉制御する制御手段とを備えているので、各蓄電器セル間で電荷を移動させて電圧を均一化し、充電時に特定の蓄電器セルが早く耐圧に達するのを防止することができる。これにより、蓄電器セル群の使用電圧範囲を広げるとともに蓄電器セル群全体としての寿命を延ばすことができる。

【００４１】また請求項２に記載された発明によれば、蓄電器セル群は電気二重層型蓄電器から成るので、蓄電器セル群を小型化しても大容量を得ることが可能となり、エネルギー密度の高い電源システムを構成することができる。

【００４２】また請求項３に記載された発明によれば、電圧補正用蓄電器の静電容量値は蓄電器セルの静電容量値に対して充分に小さい値であるので、蓄電器セルからの電荷によって電圧補正用蓄電器の電圧を短時間で上昇させ、速やかに各蓄電器セルの電圧を均一化することが可能となる。

【００４３】また請求項４に記載された発明によれば、蓄電器セル選択手段は蓄電器セルを電圧が高い順に選択するので、蓄電器セル群内の複数の蓄電器セル間の最大電圧差を速やかに減少させて各蓄電器セルの電圧を均一化することが可能となる。

【００４４】また請求項５に記載された発明によれば、制御手段は開閉手段を開閉して蓄電器セル及び電圧補正用蓄電器を接続する接続時間及び周期を制御するので、各蓄電器セルの電圧を任意に制御することができる。

【００４５】また請求項６に記載された発明によれば、蓄電器セル群を複数個直列に接続し、各蓄電器セル群に

接続された第１の電圧補正用蓄電器を第２の電圧補正用蓄電器に選択的に接続するので、全ての蓄電器セルの電圧を１個の第１の電圧補正用蓄電器で均一化する場合に比べて均一化に要する時間を短縮することができるだでなく、各第１の電圧補正用蓄電器の電圧を第２の電圧補正用蓄電器で均一化して、全ての蓄電器セルの均一化に要する時間を更に短縮することができる。

【００４６】また請求項７に記載された発明によれば、蓄電器セル群を複数個直列に接続し、各蓄電器セル群に接続された電圧補正用蓄電器を、自己の蓄電器セル群の蓄電器セルと他の蓄電器セル群の何れかの蓄電器セルとに選択的に接続するので、全ての蓄電器セルの電圧を１個の電圧補正用蓄電器で均一化する場合に比べて均一化に要する時間を短縮することができるだけでなく、各電圧補正用蓄電器の電圧を他の蓄電器セル群の何れかの蓄電器セルとの間の電荷移動により均一化して、全ての蓄電器セルの均一化に要する時間を更に短縮することができる。

【００４７】また請求項８に記載された発明によれば、走行用駆動源としてエンジン及びモータを備えたハイブリッド車両において、蓄電器セル群は発電機が発電した電力を蓄電してモータを駆動するので、発電機が発電した電力を蓄電器セル群に蓄えてモータの駆動に有効に利用することができる。特にバッテリとの併用電源として使用するときには、回生時の急激なエネルギー吸収及び蓄電が良好に行われ、またバッテリの満充電時には蓄電器セル群にエネルギーを分岐して蓄電を行うことができる。しかも蓄電器セル群はバッテリに比べて出力密度が高いので車両の軽量化が可能となる。

【図面の簡単な説明】

【図１】本発明をハイブリッド車両に適用した制御系のブロック図

【図２】電圧制御回路の回路図

【図３】電荷移動の作用説明図

【図４】作用を説明するフローチャート

【図５】最大接続時間の説明図

【図６】効果を説明するグラフ

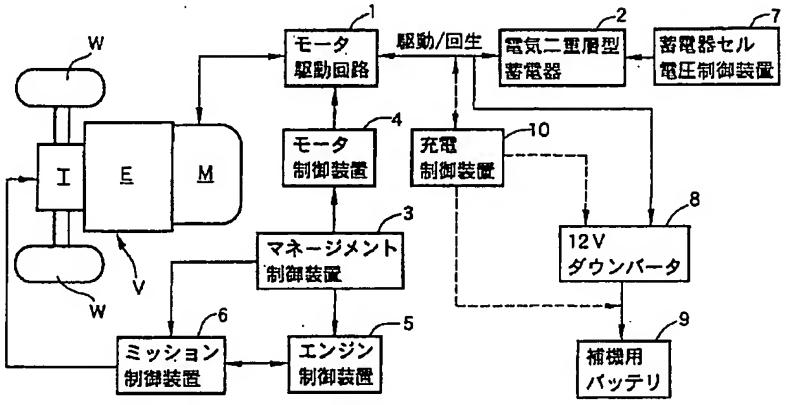
【図７】本発明の第２実施例に係る電圧制御回路の回路図

【図８】本発明の第３実施例に係る電圧制御回路の回路図

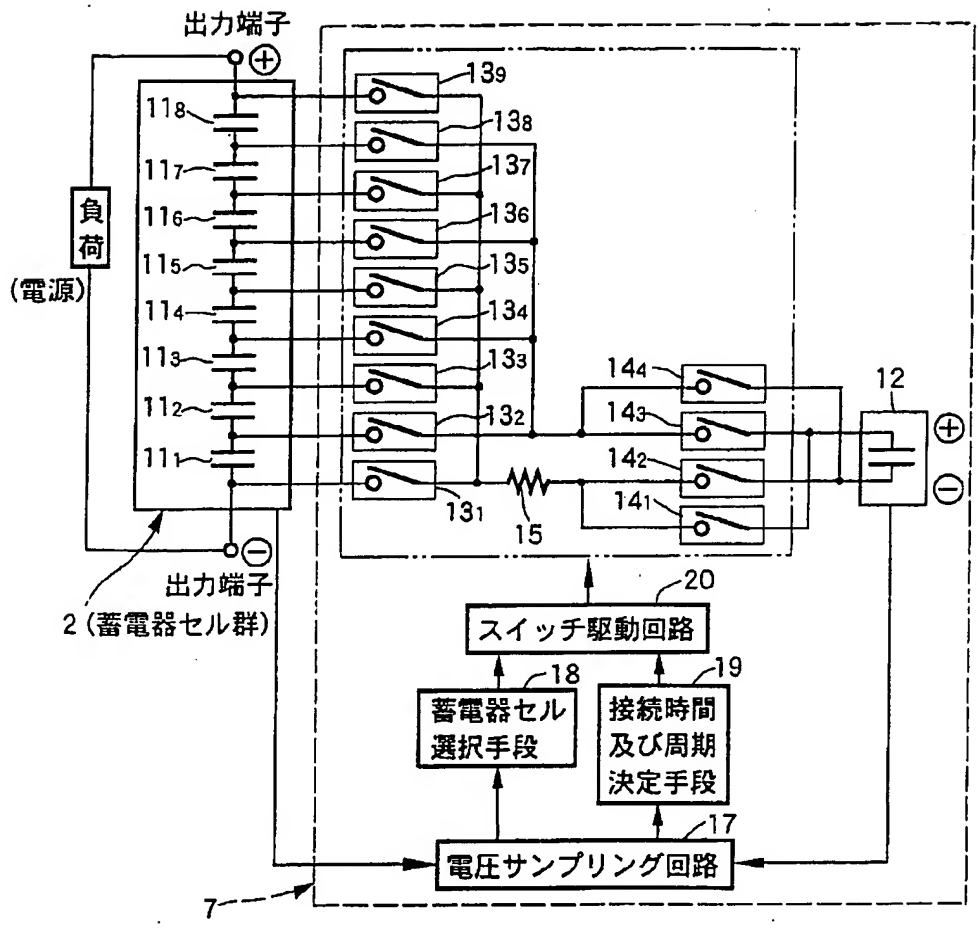
【符号の説明】

2	蓄電器セル群（電気二重層型蓄電器）
11_1 ～ 11_8	蓄電器セル
12	電圧補正用蓄電器（第１の電圧補正用蓄電器）
13_1 ～ 13_9	セル切換スイッチ（開閉手段）
14_1 ～ 14_4	極性反転スイッチ（開閉手段）
16	回路
18	蓄電器セル選択手段
19	接続時間及び周期決定手段（制御手段）
21	第２の電圧補正用蓄電器
E	エンジン
M	モータ（発電機）
V	ハイブリッド車両

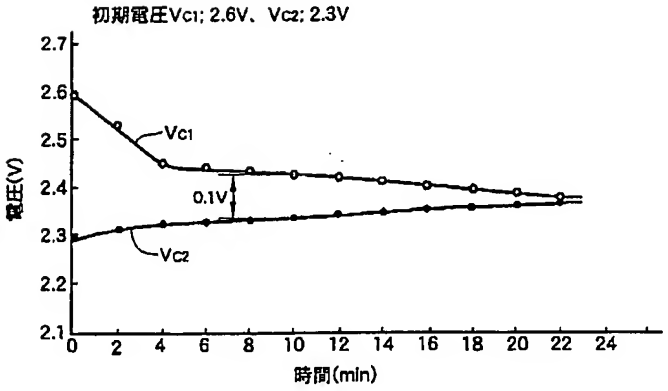
【図１】



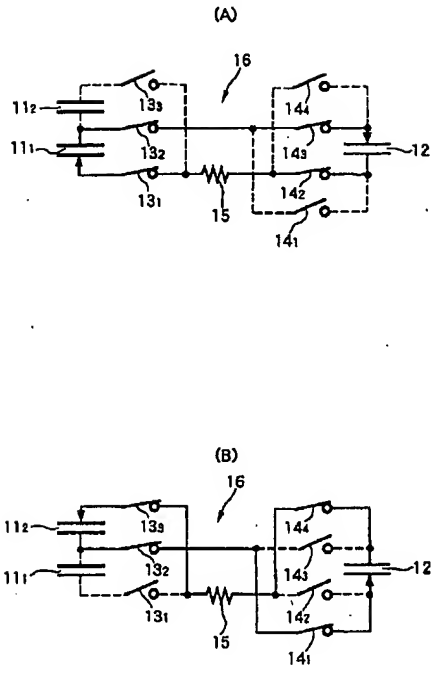
【図２】


出力端子
負荷
(電源)
出力端子
2 (蓄電器セル群)
スイッチ駆動回路
蓄電器セル選択手段
接続時間及び周期決定手段
電圧サンプリング回路
7
15
12
20
17
18
19

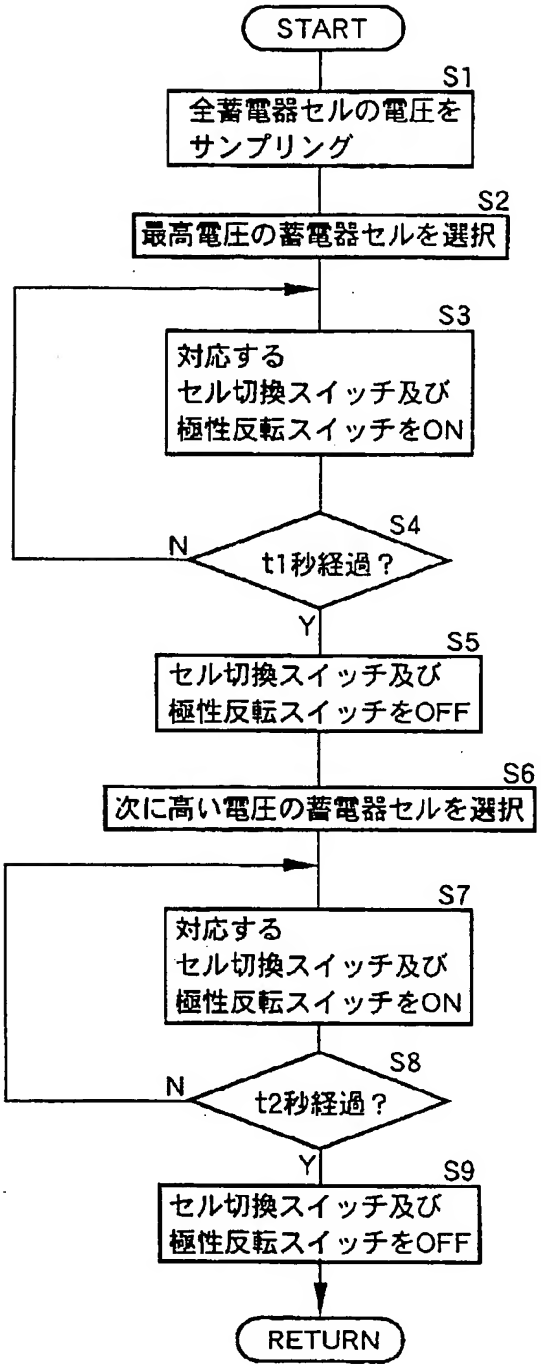
【図６】


初期電圧Vc1; 2.6V、Vc2; 2.3V
Vc1
Vc2
0.1V
電圧(V)
時間(min)

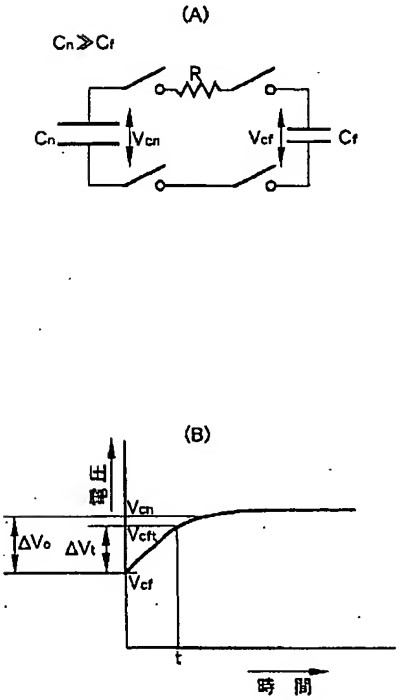
【図３】


(A)
16
11₂
11₁
13₃
13₂
13₁
15
14₄
14₃
14₂
14₁
12
(B)
16
11₂
11₁
13₃
13₂
13₁
15
14₄
14₃
14₂
14₁
12

【図４】


START
S1
全蓄電器セルの電圧をサンプリング
S2
最高電圧の蓄電器セルを選択
S3
対応するセル切換スイッチ及び極性反転スイッチをON
S4
t1秒経過？
N
Y
S5
セル切換スイッチ及び極性反転スイッチをOFF
S6
次に高い電圧の蓄電器セルを選択
S7
対応するセル切換スイッチ及び極性反転スイッチをON
S8
t2秒経過？
N
Y
S9
セル切換スイッチ及び極性反転スイッチをOFF
RETURN

【図５】


(A)
Cn≫Cf
R
Cn
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出力
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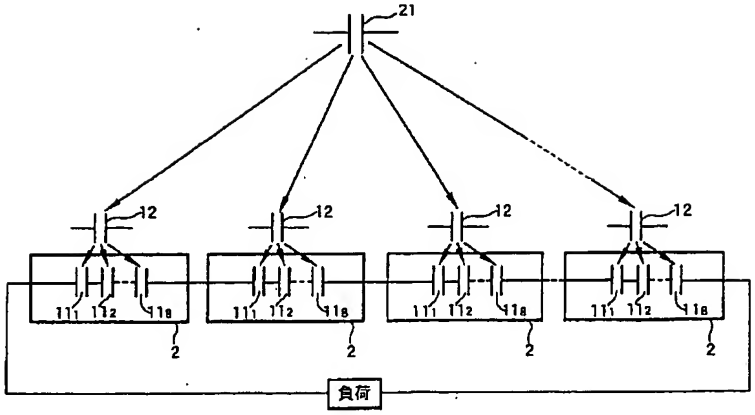
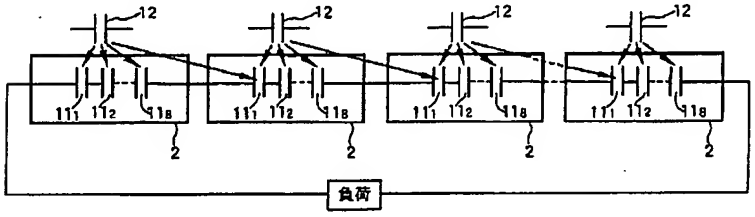
時間

【図７】



【図８】



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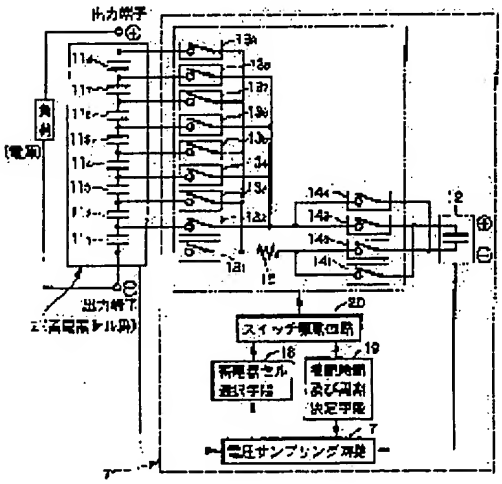
(54) VOLTAGE CONTROL DEVICE FOR CAPACITOR

(57)Abstract:
PROBLEM TO BE SOLVED: To expand the applied voltage range for a capacitor cell group as a whole by eliminating voltage difference resulting from fluctuation of performance of individual capacitor cells.
SOLUTION: Eight capacitor cells 111 to 118 forming a capacitor cell group 2 are selectively connected to a capacitor 12 for voltage compensation via nine cell changeover switches 131 to 139, four polarity inversion switches 141 to 144 and one current limiting resistor 15. Even if the voltages of each capacitor 111 to 118 are fluctuated, the voltages of the capacitor 111 to 118 can be equalized by moving the charges to the capacitor 12 for voltage compensation from the capacitor cell of higher voltage and then moving the charges of the capacitor 12 for voltage compensation to the capacitor cell of lower voltage.



2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the armature-voltage control equipment of the capacitor for equalizing the electrical potential difference of each of said capacitor cel (111-118) of the capacitor cel group (2) which comes to connect two or more capacitor cels (111-118) with a serial The capacitor for electrical-potential-difference amendment connected to juxtaposition to each capacitor cel (111-118) (12), A capacitor cel selection means to choose the capacitor cel (111-118) of arbitration (18), A closing motion means to constitute the circuit (16) for performing charge transfer between the selected capacitor cel (111-118) and the capacitor for electrical-potential-difference amendment (12) (131-139 and 141-144), Armature-voltage control equipment of the capacitor characterized by having the control means (19) which carries out closing motion control of the closing motion means (131-139 and 141-144).
[Claim 2] Said capacitor cel group (2) is armature-voltage control equipment of a capacitor according to claim 1 characterized by consisting of an electric double layer mold capacitor.
[Claim 3] The electrostatic-capacity value of the capacitor for electrical-potential-difference amendment (12) is armature-voltage control equipment of a capacitor according to claim 1 characterized by being a value small enough to the electrostatic-capacity value of a capacitor cel (111-118).
[Claim 4] A capacitor cel selection means (18) is armature-voltage control equipment of a capacitor according to claim 1 characterized by choosing a capacitor cel (111-118) as order with a high electrical potential difference.
[Claim 5] A control means (19) is armature-voltage control equipment of a capacitor according to claim 1 characterized by controlling the connect time and period which open and close a closing motion means (131-139 and 141-144), and connect a capacitor cel (111-118) and the capacitor for electrical-potential-difference amendment (12).
[Claim 6] Armature-voltage control equipment of a capacitor according to claim 1 characterized by connecting alternatively to the 2nd capacitor for electrical-potential-difference amendment (21) the 1st capacitor for electrical-potential-difference amendment (12) which connected two or more said capacitor cel groups (2) to the serial, and was connected to each capacitor cel group (2).
[Claim 7] Armature-voltage control equipment of a capacitor according to claim 1 characterized by connecting alternatively to the capacitor cel (111-118) of the capacitor cel group (2) of self, and which capacitor cel (111-118) of other capacitor cel groups (2) the capacitor for electrical-potential-difference amendment (12) which connected two or more said capacitor cel groups (2) to the serial, and was connected to each capacitor cel group (2).
[Claim 8] It is armature-voltage control equipment of a capacitor according to claim 1 characterized by storing electricity the power with which the generator (M) generated said capacitor cel group (2) in the hybrid car (V) equipped with the engine (E) and the motor (M) as a driving source for transit, and driving a motor (M).

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the armature-voltage control equipment of the capacitor for equalizing the electrical potential difference of each capacitor cel in the capacitor which connected two or more capacitor cels to the serial.
[0002]
[Description of the Prior Art] In the hybrid car equipped with the engine and the motor as a driving source for transit, the thing equipped with the capacitor which connected two or more capacitor cels to the serial is known by JP,7-163014,A as a power source which drives a motor.
[0003] In this capacitor, the electrical potential difference of each capacitor cel becomes an ununiformity by dispersion on the engine performance (capacity, a self-discharge current, internal resistance, etc.), a capacitor cel with a high electrical potential difference reaches pressure-proofing early at the time of charge, the service voltage range as the whole capacitor may narrow, or endurance may fall. Then, a power surge is stopped, or it connects with resistance or a capacitor at the capacitor cel which is going to connect zener diode to the capacitor cel which reaches pressure-proofing early, and is going to reach pressure-proofing, and the above-mentioned conventional thing stops a power surge, and is coping with it.
[0004]
[Problem(s) to be Solved by the Invention] However, since it is not what what was indicated by JP,7-163014,A equalizes the electrical potential difference of each capacitor cel at the time of the full charge of a capacitor, it cannot demonstrate effectiveness when continuing and using it with intermediate voltage, and compensates the engine-performance difference of the proper of each capacitor cel, on the occasion of prolonged use, among other capacitor cels, an electrical-potential-difference difference may occur and the service voltage range may narrow.
[0005] This invention was made in view of the above-mentioned situation, and cancels the electrical-potential-difference difference by dispersion in the engine performance of each capacitor cel, and while expanding the service voltage range as the whole capacitor, it aims at raising endurance.
[0006]
[Means for Solving the Problem] A control means opens and closes a closing motion means, and the predetermined capacitor cel and the capacitor for electrical-potential-difference amendment which the capacitor cel selection means chose are connected in invention indicated by claim 1. After moving the charge of a capacitor cel to the capacitor for electrical-potential-difference amendment, the charge of the capacitor for electrical-potential-difference amendment is moved to other capacitor cels, and the electrical potential difference of each capacitor cel is equalized by repeating this.
[0007] The electric double layer mold capacitor which constitutes a capacitor cel group is small, and since it can acquire large capacity, it can constitute a power-source system with high energy density from invention indicated by claim 2 using this electric double layer mold capacitor.
[0008] In invention indicated by claim 3, since the electrostatic-capacity value of the

capacitor for electrical-potential-difference amendment is a value small enough to the electrostatic-capacity value of a capacitor cel, the capacitor for electrical-potential-difference amendment can be charged with the charge from a capacitor cel in a short time, and it enables this to equalize the electrical potential difference of each capacitor cel promptly.

[0009] In invention indicated by claim 4, since it connects with the capacitor for electrical-potential-difference amendment sequentially from a capacitor cel with the highest electrical potential difference, a charge is moved to a capacitor cel with a low electrical potential difference from a capacitor cel with a high electrical potential difference, the maximum electrical-potential-difference difference of two or more capacitor cels in a capacitor cel group is decreased effectively, and it becomes possible to equalize the electrical potential difference of each capacitor cel promptly.

[0010] Since the connect time and period which connect a capacitor cel and the capacitor for electrical-potential-difference amendment when a control means opens and closes a closing motion means are controlled, the electrical potential difference of each capacitor cel is controllable by invention indicated by claim 5 to arbitration.

[0011] In invention indicated by claim 6, since two or more capacitor cel groups equipped with the 1st capacitor for electrical-potential-difference amendment, respectively are connected to a serial, the time amount which the number of capacitor cels with which the 1st one capacitor for electrical-potential-difference amendment shares the electrical potential difference of all capacitor cels compared with the case where it equalizes with the 1st one capacitor for electrical-potential-difference amendment becomes fewer, and equalization of an electrical potential difference takes is shortened. and every -- since the electrical potential difference of the 1st capacitor for electrical-potential-difference amendment is equalized by the 2nd capacitor for electrical-potential-difference amendment, the time amount which equalization of the electrical potential difference of all capacitor cels takes is shortened further.

[0012] In invention indicated by claim 7, since two or more capacitor cel groups equipped with the capacitor for electrical-potential-difference amendment, respectively are connected to a serial, the time amount which the number of capacitor cels with which one capacitor for electrical-potential-difference amendment shares the electrical potential difference of all capacitor cels compared with the case where it equalizes with one capacitor for electrical-potential-difference amendment becomes fewer, and equalization of an electrical potential difference takes is shortened. And since the electrical potential difference of each capacitor for electrical-potential-difference amendment is equalized by the charge transfer between which capacitor cels of other capacitor cel groups, the time amount which equalization of the electrical potential difference of all capacitor cels takes is shortened further.

[0013] In invention indicated by claim 8, the power which the generator generated can be stored in a capacitor cel group, and it can use effective in the drive of a motor, and moreover, since power density is high compared with a dc-battery, lightweight-ization of a car of a capacitor cel group is attained.

[0014]

[Embodiment of the Invention] Hereafter, it explains based on the example of this invention which showed the gestalt of operation of this invention to the accompanying drawing.

[0015] It is the graph with which drawing 1 - drawing 6 show the 1st example of this invention, the block diagram of a control system with which drawing 1 applied this invention to the hybrid car, the flow chart with which the circuit diagram of an armature-voltage control circuit and drawing 3 explain the operation explanatory view of charge transfer, and, as for drawing 4 , drawing 2 explains an operation, and drawing 5 explain the explanatory view of Maximum connection time amount, and drawing 6 explains effectiveness.

[0016] As shown in drawing 1 , the hybrid car V of a parallel mold is equipped with Motor M and Transmission T in which Engine E, a drive, and regeneration are possible, and Motor M is connected to the capacitor cel group 2 through the motorised circuit 1. Said capacitor cel group 2 is small, and consists of cel groups of an electric double layer mold capacitor which can acquire large capacity. Regenerative braking of the motor M is carried out at the case where the driving force of Engine E and/or Motor M was transmitted to the driving wheel W through Transmission T at the time of transit of Car V, and a surplus arises in the driving force of Engine E, or the time of braking, and the capacitor cel group 2 stores electricity the power which Motor M generated.

[0017] Motor control equipment 4, the engine control system 5, and the missions control device 6 are connected to the management control device 3, by motor control equipment 4, Engine E is controlled by the engine control system 5, and Transmission M is controlled for said motorised circuit 1 by the missions control device 6, respectively. The capacitor cel group 2 is controlled by the capacitor cel armature-voltage control equipment 7 explained in full detail later.

[0018] The motorised circuit 1 and the capacitor cel group 2 are connected to the 12-volt dc-battery 9 for auxiliary machinery through 12V down barter 8, and these capacitor cel group 2 and the dc-battery 9 for auxiliary machinery are controlled by the charge control unit 10.

[0019] Thus, since the capacitor cel group 2 stores electricity the power which Motor M generated and drives this motor M, it can store the driving force of the surplus of Engine E, and the driving force thrown away by braking in the capacitor cel group 2, and can use it effective in the drive of Motor M. Moreover, since the capacitor cel group 2 with high power density is used compared with the dc-battery, lightweight-ization of Car V is attained.

[0020] As shown in drawing 2, the capacitor cel groups 2 are eight capacitor cels 111-118 of the same specification. It connects with a serial and is each capacitor cel 111-118. An electrostatic-capacity value is set as 1600F. Capacitor cel armature-voltage control equipment 7 is one capacitor 12 for electrical-potential-difference amendment, and nine cel change-over switches 131-139. Four polarity-reversals switches 141-144 It has one resistance 15 for current limiting. Nine cel change-over switches 131-139 Two predetermined pieces and four polarity-reversals switches 141-144 When two predetermined pieces are closed, they are the predetermined capacitor cels 111-118. It connects through the circuit 16 (refer to drawing 3) which the capacitor 12 for electrical-potential-difference amendment closed. The electrostatic-capacity value of the capacitor 12 for electrical-potential-difference amendment is each capacitor cel 111-118. It is set as 10% or less of value (for example, 100F) of 1600F which is an electrostatic-capacity value.

[0021] As shown in drawing 3 (A), it is two cel change-over switches 131 and 132. Two

polarity-reversals switches 142 and 143 When it closes, it is the capacitor cel 111. While a plus pole and the plus pole of the capacitor 12 for electrical-potential-difference amendment are connected, it is the capacitor cel 111. A minus pole and the minus pole of the capacitor 12 for electrical-potential-difference amendment are connected through the resistance 15 for current limiting. Moreover, as shown in drawing 3 (B), it is two cel change-over switches 132 and 133. Two polarity-reversals switches 141 and 144 When it closes, it is the capacitor cel 112. While a plus pole and the plus pole of the capacitor 12 for electrical-potential-difference amendment are connected through the resistance 15 for current limiting, it is the capacitor cel 112. A minus pole and the minus pole of the capacitor 12 for electrical-potential-difference amendment are connected.

[0022] Capacitor cel armature-voltage control equipment 7 is further equipped with the electrical-potential-difference sampling circuit 17, the capacitor cel selection means 18, a connect time and the periodic decision means 19, and the switch drive circuit 20. The electrical-potential-difference sampling circuits 17 are eight capacitor cels 111-118. An electrical potential difference and the electrical potential difference of the capacitor 12 for electrical-potential-difference amendment are detected. The capacitor cel selection means 18 is based on said detected electrical potential difference, and is eight capacitor cels 111-118. It is chosen as order with a high electrical potential difference. A connect time and the periodic decision means 19 are said selected capacitor cel 111-118. The connect time and period linked to the capacitor 12 for electrical-potential-difference amendment are determined. The switch drive circuit 20 is said selected capacitor cel 111-118. It is based on said connect time and period which were determined, and is the cel change-over switch 131-139. And polarity-reversals switch 141-144 Closing motion is controlled.

[0023] Next, an operation of the example of this invention equipped with the above-mentioned configuration is explained.

[0024] Drawing 4 is two capacitor cels 111 whose capacitor cel groups 2 are the minimum number, and 112. It is a flow chart explaining the operation in the case of having. First, it is two capacitor cels 111 and 112 by the electrical-potential-difference sampling circuit 17. An electrical potential difference is sampled (step S1), and the capacitor cel selection means 18 chooses the capacitor cel (for example, capacitor cel 111) of the maximum electrical potential difference based on the result (step S2). Capacitor cel 111 When chosen, as shown in drawing 3 (A), the switch drive circuit 20 is two cel change-over switches 131 and 132. Two polarity-reversals switches 142 and 143 It closes (step S3). consequently, capacitor cel 111 from -- a charge moves to the capacitor 12 for electrical-potential-difference amendment through the resistance 15 for current limiting, and while the electrical potential difference of the capacitor cel 111 which discharged falls, the electrical potential difference of the charged capacitor 12 for electrical-potential-difference amendment rises. And connect time t1 determined by the connect time and the periodic decision means 19 When it passes (step S4), the switch drive circuits 20 are two cel change-over switches 131,132. Two polarity-reversals switches 142 and 143 Kaisei is carried out and it is the capacitor cel 111. It separates from the capacitor 12 for electrical-potential-difference amendment (step S5).

[0025] capacitor cel 111 from -- the time of moving a charge to the capacitor 12 for electrical-potential-difference amendment -- the electrostatic-capacity value (100F) of the capacitor 12 for electrical-potential-difference amendment -- capacitor cel 111 Since it is sharply small compared with an electrostatic-capacity value (1600F), the electrical

potential difference of the capacitor 12 for electrical-potential-difference amendment rises promptly. Thereby, it is each capacitor cel 111 and 112. An electrical potential difference can be equalized in a short time.
[0026] Then, it is if the capacitor cel selection means 18 chooses a capacitor cel with a high electrical potential difference (that is, capacitor cel 112) next (step S6). As shown in drawing 3 (B), the switch drive circuit 20 is two cel change-over switches 132 and 133. Two polarity-reversals switches 141 and 144 It closes (step S7). Consequently, the resistance 15 for current limiting is minded from the capacitor 12 for electrical-potential-difference amendment, and it is the capacitor cel 112. Capacitor cel 112 charged while the charge moved and the electrical potential difference of the capacitor 12 for electrical-potential-difference amendment which discharged fell An electrical potential difference rises. And connect time t2 determined by the connect time and the periodic decision means 19 When it passes (step S8), the switch drive circuit 20 is two cel change-over switches 132 and 133. Two polarity-reversals switches 141 and 144 Kaisei is carried out and it is the capacitor cel 112. It separates from the capacitor 12 for electrical-potential-difference amendment (step S8).
[0027] thus, capacitor cel 111 with a high electrical potential difference from -- capacitor cel 112 with a low electrical potential difference moving a charge -- capacitor cel 111 an electrical potential difference -- falling -- capacitor cel 112 an electrical potential difference -- going up -- both the capacitor cel 111 and 112 An electrical potential difference can be equalized.
[0028] By the way, as shown in drawing 5 (A), when moving a charge to the 2nd capacitor of electrostatic capacity Cf (however, Cn>> Cf) and terminal voltage Vcf (however, Vcn>Vcf) through the resistance for current limiting of resistance R from the 1st capacitor of electrostatic capacity Cn and terminal voltage Vcn, the terminal voltage of the 2nd capacitor presupposes that it changed from Vcf to Vcft which is a desired charge electrical potential difference after [of since migration of a charge is started] t seconds. When the electrical-potential-difference difference of the 1st capacitor before charge transfer initiation and the 2nd capacitor is set to deltaV0 (=Vcn-Vcf) and the electrical-potential-difference difference in t seconds after charge transfer initiation is set to deltaVt (=Vcft-Vcf) at this time, it is t=CfxRxLn (1-delta Vt/delta V0).
It ******. In an upper type, t expresses time amount until the electrical potential difference of the 2nd capacitor rises on the desired charge electrical potential difference Vcft from Vcf after charge transfer initiation, and defines this time amount as Maximum connection time amount.
[0029] By the way, while a capacitor is not discharging [be / it] during charge, either, when it assumes that the Maximum connection time amount t per capacitor cel is 10 seconds and a capacitor has N= 100 capacitor cels, the time amount for 10x100= 1000 seconds is needed for 100 capacitor cels completing one charge transfer each, and it becomes difficult to equalize the electrical potential difference of each capacitor cel for a short time. Then, the connect time about one capacitor cel is set as t/N, into the Maximum connection time amount t, sequential connection of the capacitor cel of N individual can be made, and a charge can be moved equally [abbreviation] from the capacitor cel of N individual in 1 cycle, then a short time.
[0030] Moreover, during charge of a capacitor, or discharge, it is necessary to connect each capacitor cel with a time interval short enough so that the terminal voltage Vcn of a

capacitor cel may not change. For example, if the connect time about the capacitor cel whose number is one is set as 1-/N=1 / 100 seconds when the change rate of Vcn at the time of connection is 0.1 volts/second, the variation of Vcn in the meantime can be held down to 0.001 volts.

[0031] Thus, it is each capacitor cel 111-118 by the connect time and the periodic decision means 19. If the period linked to the capacitor 12 for electrical-potential-difference amendment is changed, it will be each capacitor cel 111-118. It also becomes possible to control an electrical potential difference to arbitration.

[0032] Drawing 6 is two capacitor cels 111 shown in drawing 3, and 112. It sets in the capacitor cel group 2 which it had, and is the capacitor cel 111. The initial voltage Vc of 1 = 2.6 volts, and capacitor cel 112 From a 2 = 2.3 volts [of initial voltage Vc] condition, the experimental result at the time of moving a charge in 1 cycle 25 seconds is shown. The electrical-potential-difference difference whose 0.3 volts were at first so that clearly from this drawing decreases to 0.1 volts after about 10 minutes, and it is both the capacitor cel 111 and 112. It turns out that the electrical potential difference was equalized.

[0033] As mentioned above, eight capacitor cels 111 of the capacitor cel group 2 and 118 It is each capacitor cel 111-118 by moving a charge in between. Since the electrical potential difference is equalized Capacitor cel 111-118 predetermined to the time of charge It can prevent reaching pressure-proofing early, and a life is extensible while this expands the service voltage range as the capacitor cel group 2 whole.

[0034] Next, the 2nd example of this invention is explained based on drawing 7 .

[0035] The 2nd example connects two or more capacitor cel group 2 -- to a serial. Like the 1st example, each capacitor cel group 2 is equipped with the capacitor 12 (1st capacitor 12 for electrical-potential-difference amendment) for electrical-potential-difference amendment, and capacitor 12 -- for electrical-potential-difference amendment of these plurality is connected to the 2nd common capacitor 21 for electrical-potential-difference amendment by turns. Thus, if two or more capacitor cel group 2 -- equipped with the capacitor 12 for electrical-potential-difference amendment, respectively is connected to a serial, in order to obtain the high voltage, even if it uses many capacitor cels, the time amount which holds down the number of the capacitor cels which one capacitor 12 for electrical-potential-difference amendment shares to the predetermined number (eight pieces), and equalization of the electrical potential difference of all capacitor cels takes can be shortened. And since each capacitor 12 -- for electrical-potential-difference amendment is alternatively connected to the 2nd capacitor 21 for electrical-potential-difference amendment, with the 2nd capacitor 21 for electrical-potential-difference amendment, an electrical potential difference can be equalized and the time amount of each capacitor 12 -- for electrical-potential-difference amendment which equalization of the electrical potential difference of all capacitor cels takes can be shortened further.

[0036] Next, the 3rd example of this invention is explained based on drawing 8 .

[0037] Two or more capacitor cel group 2 -- is connected to a serial like [the 3rd example] the 2nd example. The capacitors 12 for electrical-potential-difference amendment of each capacitor cel group 2 are eight capacitor cels 111-118 of the capacitor cel group 2 of self. It connects with one capacitor cel (for example, capacitor cel 111) of the adjoining capacitor cel group 2 alternatively. Therefore, capacitor cel 111 of the

capacitor cel group 2 which adjoins the electrical potential difference of each capacitor 12 for electrical-potential-difference amendment not to mention the ability to shorten the time amount which holds down the number of the capacitor cels which one capacitor 12 for electrical-potential-difference amendment shares to nine pieces, and equalization of an electrical potential difference takes It can equalize by transfer of the charge of a between and the time amount which equalization of the electrical potential difference of all capacitor cels takes can be shortened further.

[0038] As mentioned above, although the example of this invention was explained in full detail, this invention can perform design changes various in the range which does not deviate from the summary.

[0039] For example, at an example, the capacitor cel groups 2 are eight capacitor cels 111-118. Although had, the number is not limited to eight pieces. Moreover, invention indicated by claims 1-4 is not limited to hybrid cars, but can be applied to the capacitor of the application of arbitration. Moreover, invention indicated by claim 8 can also apply a generator and a motor to the hybrid car which it had separately. Furthermore, it is possible to use together the capacitor cel group 2 and a dc-battery, if it does in this way, the rapid energy absorption and the accumulation of electricity at the time of regeneration can be performed good, and it can store electricity by branching energy in the capacitor cel group 2 at the time of the full charge of a dc-battery.

[0040]

[Effect of the Invention] As mentioned above, the capacitor for electrical-potential-difference amendment which was connected to juxtaposition to each capacitor cel according to invention indicated by claim 1, Since it has a closing motion means to constitute the circuit for performing charge transfer, and the control means which carries out closing motion control of the closing motion means between a capacitor cel selection means to choose the capacitor cel of arbitration, and the selected capacitor cel and the capacitor for electrical-potential-difference amendment A charge can be moved between each capacitor cel, an electrical potential difference can be equalized, and it can prevent that a specific capacitor cel reaches pressure-proofing early at the time of charge. Thereby, while extending the service voltage range of a capacitor cel group, the life as the whole capacitor cel group can be prolonged.

[0041] Moreover, according to invention indicated by claim 2, since a capacitor cel group consists of an electric double layer mold capacitor, even if it miniaturizes a capacitor cel group, it becomes possible [acquiring large capacity], and can constitute a power-source system with high energy density.

[0042] Moreover, according to invention indicated by claim 3, since the electrostatic-capacity value of the capacitor for electrical-potential-difference amendment is a value small enough to the electrostatic-capacity value of a capacitor cel, the electrical potential difference of the capacitor for electrical-potential-difference amendment is raised with the charge from a capacitor cel for a short time, and it becomes possible to equalize the electrical potential difference of each capacitor cel promptly.

[0043] Moreover, according to invention indicated by claim 4, since a capacitor cel selection means chooses a capacitor cel as order with a high electrical potential difference, it becomes possible [decreasing promptly the maximum electrical-potential-difference difference between the capacitor cels of the plurality in a capacitor cel group, and equalizing the electrical potential difference of each capacitor cel].

[0044] Moreover, since a control means controls the connect time and period which open and close a closing motion means and connect a capacitor cel and the capacitor for electrical-potential-difference amendment according to invention indicated by claim 5, the electrical potential difference of each capacitor cel is controllable to arbitration.
[0045] Moreover, since the 1st capacitor for electrical-potential-difference amendment which connected two or more capacitor cel groups to the serial, and was connected to each capacitor cel group is alternatively connected to the 2nd capacitor for electrical-potential-difference amendment according to invention indicated by claim 6 The electrical potential difference of the 1st capacitor for electrical-potential-difference amendment is equalized with the 2nd capacitor for electrical-potential-difference amendment. not ** that can shorten the time amount which equalization takes the electrical potential difference of all capacitor cels compared with the case where it equalizes with the 1st one capacitor for electrical-potential-difference amendment but every -- The time amount which equalization of all capacitor cels takes can be shortened further.
[0046] Moreover, according to invention indicated by claim 7, two or more capacitor cel groups are connected to a serial. Since the capacitor for electrical-potential-difference amendment connected to each capacitor cel group is alternatively connected to the capacitor cel of the capacitor cel group of self, and which capacitor cel of other capacitor cel groups It not only can shorten the time amount which equalization takes the electrical potential difference of all capacitor cels compared with the case where it equalizes with one capacitor for electrical-potential-difference amendment, but The electrical potential difference of each capacitor for electrical-potential-difference amendment can be equalized by the charge transfer between which capacitor cels of other capacitor cel groups, and the time amount which equalization of all capacitor cels takes can be shortened further.
[0047] Moreover, according to invention indicated by claim 8, in the hybrid car equipped with the engine and the motor as a driving source for transit, since a capacitor cel group stores electricity the power which the generator generated and drives a motor, it can store the power which the generator generated in a capacitor cel group, and can use it effective in the drive of a motor. When using it as a concomitant use power source with a dc-battery especially, the rapid energy absorption and the accumulation of electricity at the time of regeneration are performed good, and it can store electricity by branching energy in a capacitor cel group at the time of the full charge of a dc-battery. And since power density is high compared with a dc-battery, lightweight-ization of a car of a capacitor cel group is attained.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram of the control system which applied this invention to the hybrid car
[Drawing 2] The circuit diagram of an armature-voltage control circuit
[Drawing 3] The operation explanatory view of charge transfer
[Drawing 4] The flow chart explaining an operation
[Drawing 5] The explanatory view of Maximum connection time amount

[Drawing 6] The graph explaining effectiveness
[Drawing 7] The circuit diagram of the armature-voltage control circuit concerning the 2nd example of this invention
[Drawing 8] The circuit diagram of the armature-voltage control circuit concerning the 3rd example of this invention
[Description of Notations]
2 Capacitor Cel Group (Electric Double Layer Mold Capacitor)
111 - 118 Capacitor Cel
12 Capacitor for Electrical-Potential-Difference Amendment (1st Capacitor for Electrical-Potential-Difference Amendment)
131 - 139 Cel Change-over Switch (Closing Motion Means)
141 - 144 Polarity-Reversals Switch (Closing Motion Means)
16 Circuit
18 Capacitor Cel Selection Means
19 Connect Time and Periodic Decision Means (Control Means)
21 2nd Capacitor for Electrical-Potential-Difference Amendment
E Engine
M Motor (generator)
V Hybrid car

DRAWINGS

[Drawing 1]

[Drawing 2]

[Drawing 6]

[Drawing 3]

[Drawing 4]

[Drawing 5]

[Drawing 7]

[Drawing 8]